METHODS OF CAPTURE AND RADIO TRACKING OF WESTERN TRAGOPAN *TRAGOPAN MELANOCEPHALUS* J.E. GRAY 1829 IN THE GREAT HIMALAYAN NATIONAL PARK, INDIA[1]

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Attempts were made to capture and radio track the Western Tragopan (*Tragopan melanocephalus* J.E. Gray 1829) in the Great Himalayan National Park, Himachal Pradesh, India. Leg-hold snares and automated fall nets were used to trap the birds. During the intensive efforts of 6,694 trap hours, one female Western Tragopan and 12 other bird species were captured. The trapped Western Tragopan was radio-tagged with necklace collar and was tracked for six months. Using 72 radio locations and Minimum Convex Polygon Method, the estimated home range was 31.6 ha, and it was 20.5 ha for summer and 4.7 ha for autumn. The bird showed preference for high tree cover, thick undergrowth of montane bamboo, high litter cover and perennial water sources. In addition, much of the findings on its ecology broadly corroborated with the earlier observations, suggesting that in spite of a very low sample size, credible information could be gathered through radio tracking and data collection at a finer scale. This study still remains the only investigation involving trapping and radio tagging of the Western Tragopan anywhere in the world. We recommend that the approach and methods adopted in this study be taken forward for not only the Western Tragopan, but also for other ground dwelling birds with similar habits, for generating decisive ecological information and subsequent conservation planning for these species.

Key words: Habitat use, Himalayas, home range, live trapping, pheasants, telemetry

INTRODUCTION

The Western Tragopan (*Tragopan melanocephalus* J.E. Gray 1829) is among the rarest pheasant species, confined to the temperate region of the north-west Himalaya in a narrow belt between Swat catchments in the North West Frontier Province, Pakistan and western Uttarakhand in India (Fuller and Garson 2000; BirdLife International 2001). With only 2,000-3,000 sq. km area of potential habitat available, its world population size is precariously low, with arguably much fewer than 5,000 individuals distributed in five fragmented populations (Gaston *et al.* 1983a; Johnsgard 1986; BirdLife International 2001). This population estimate obtained 25 years ago was based on limited records and is still to be validated. Even a review on the current status using empirical evidences, which is an urgent need, is unlikely to project a better population status, as habitat degradation, poaching and rampant use of habitat for minor forest produce collection continue to affect the species (Fuller and Garson 2000). On the other hand, attempts to evolve conservation strategies have been greatly constrained by inadequate scientific data on its habitat requirements and other life history traits. Prior to this study, the six months study by Islam (1985) in Pakistan was the only intensive effort to study the ecology of the species. Rest of the attempts were of short-term surveys primarily aiming at spatial distribution and population status of the species (Mirza *et al.* 1978; Islam 1982; Gaston *et al.* 1983b; Duke 1990; Pandey 1994; Jandrotia *et al.* 1995; Jandrotia *et al.* 2000; Whale 1996; Nawaz 1999). Ecological inferences from these efforts were constrained by low sighting records, attributed to low population density compounded with elusive behaviour of the bird. Therefore, even with these hard efforts, our understanding of the species biology remained obscure.

Systematic monitoring of adequate number of radio-tagged birds was an option to study and draw definite inference on the species biology. Moreover, the information on home range and movement pattern for such a threatened species are critical to estimate potential habitat and population size at a regional scale. Therefore, attempts were made to capture and radio-tag at least six individuals of the Western Tragopan in the Great Himalayan National Park (GHNP), which is one of the few strongholds for this species in India. The number was originally kept to a minimum of six considering the cost involved and threatened status of the bird, and that the number was to be increased once these six tags were successfully deployed. In this paper, we present the methods adopted to live trap the Western Tragopan, trap efficiency, ecological observations on the radio-tracked bird and suggestions for possible improvement of such studies in the future.

MATERIAL AND METHODS

Study site: The study was carried out from April to November 1999 in GHNP, which is situated about 40 km east of Kullu town in the state of Himachal Pradesh, India (31° 33'-31° 56' N; 77° 17'-77° 52' E). It covers an area of 754.4 sq. km constituted by four major watersheds – Tirthan, Sainj, Jiwa and Parvati, all of these form a part of Beas catchments. The altitude ranges from 1,344 to 6,248 m, representing diverse vegetation types from subtropical forests to alpine meadows. Tirthan valley of this Park became a natural choice for this study, since this effort was merely an extension of an already ongoing intensive research on habitat ecology of three sympatric pheasants, including the Western Tragopan, which began in April 1997. The logistics and infrastructure had already been established in this area by the intensive research project, besides the field experiences in the last few years enabled us to plan the study appropriately (Ramesh 2003).

Traps and trapping: Trapping was attempted using fall nets (N = 6) and leg-hold noose (N = 9), between April and June 1999. The fall net was a combination of 'automatic fall net' and 'walk-in trap' described by Bub (1991). The nets were considerably large, 15 to 18 m long, 6 m wide with a mesh size of 40 x 40 mm. All the nets were coloured black and dark green, to provide a camouflage effect. The nets were placed in such a way that 3 m of the net was set lying on the ground and the remaining 3 m standing at 50° angle supported by triggers which, in this case, were bamboo sticks (Fig. 1). The net would fall down upon the release of the trigger when disturbed by the bird while walking into the trap. Leg-hold noose is an indigenous trap method used by local people to trap large birds in some parts of north India.

The leg-hold noose has a series of 40-50 independent nooses fixed at 15 cm interval on a thin but strong rope (Fig. 2). The noose was made up of nylon and measured 30 cm in diameter, and was fixed with a bamboo at the base of the noose. The stick, which in this case was 10 cm long and of 2 cm girth, was pressed into the soft soil, leaving only

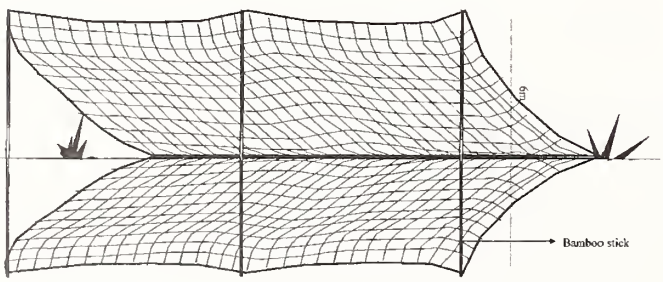

Fig. 1: Diagrammatic representation of fall net

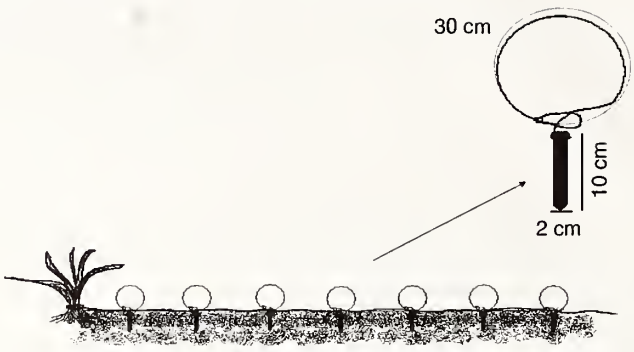

Fig. 2: Diagrammatic representation of leg-hold noose

the noose part on the ground sticking out at 90° angle. One end of the trap was tied to a nearby pole or a shrub that could hold back the trap when the trapped bird tries to pull away, where as the other end is left loose. This set up prevents the bird from breaking away from the trap, while enabling the bird to move around without inflicting any sort of damage to its leg.

Traps were set in 12 locations representing different forest types (n = 6), *thatches* (forest clearing used as livestock camps) (n = 2) and *nullahs* (small streams of both perennial and seasonal) (n = 4). A total of 6,694 trap hours, constituted by 3,927 net hours and 2,767 noose hours, were spent during the entire trapping sessions. These efforts were distributed disproportionately in the above three locations, with relative preference for locations regarded to yield better trap success. Correspondingly, the entire trap efforts represent 1,783 trap hours (953 net hours and 830 noose hours) in forest, 815 trap hours (501 net hours and 314 noose hours) in *thatches* and 4,096 trap hours (2,473 net hours and 1,623 noose hours) in *nullahs*. The traps were placed on the ground at previously identified sites such as water holes, roost sites and daily movement area, which were monitored periodically. Besides this, on locating or hearing the bird, the fall net was set up at 200 m away from the bird on the uphill and 3-4 persons, forming a semicircle, would slowly drive the bird towards the net. A total of 256 man-days (4 persons x 64 days in three months) were spent in the altitudinal range of 2,600-3,000 m, where relatively high concentration of the Western Tragopan was sighted during the three years of fieldwork.

Tagging and telemetry: The trapped bird was fitted with a necklace type (Biotrack) radio transmitter weighing about 50 gm, which had a potential life span of over 12 months. Triangulation method (Kenward 2001) was preferred over home-in method after testing the method for three consecutive sampling days. It was found that during the home-in method, the movement of the bird was found to be influenced by the observer while zeroing-in. Radio locations were recorded once in three sampling time sessions

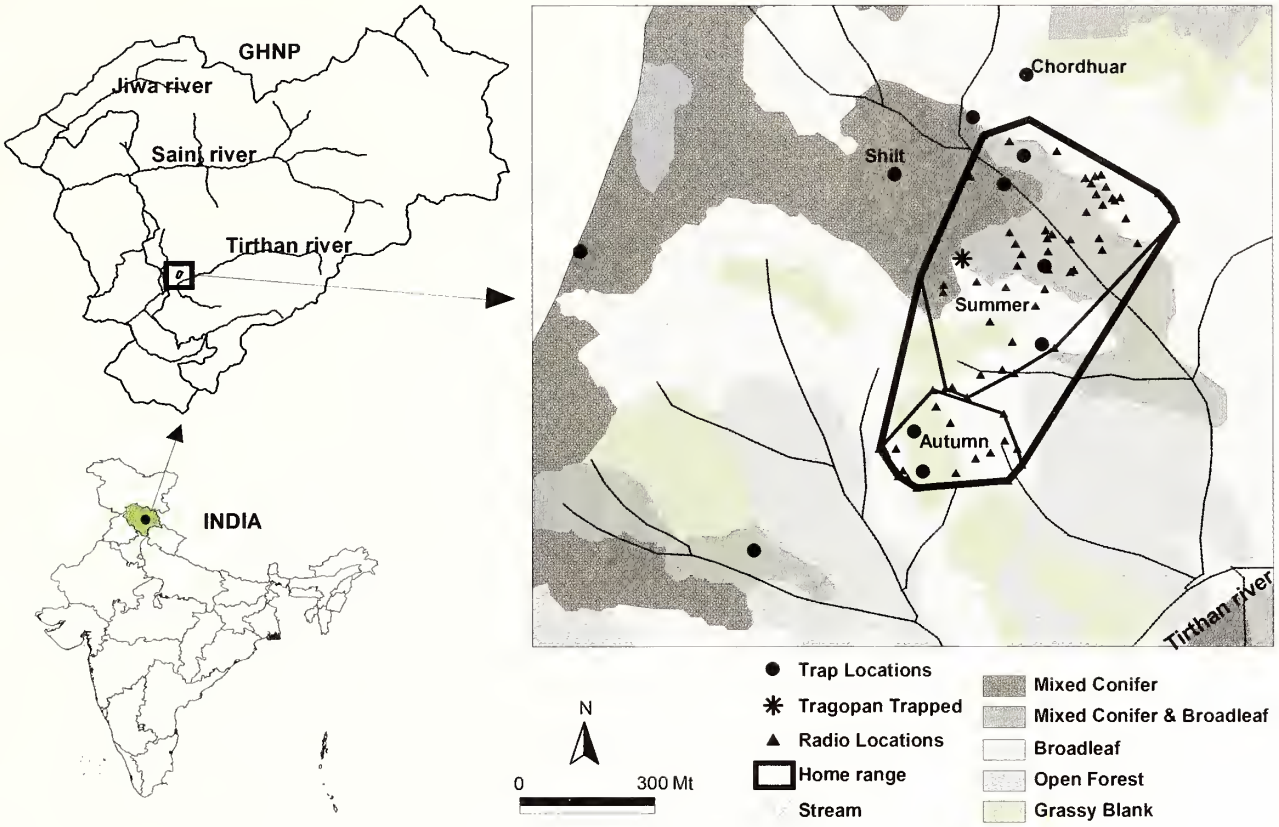

Fig. 3: Trapping location and home range of the radio-tagged female Western Tragopan

(6-11 hrs, 10-15 hrs and 15-18 hrs) every third day. The bird was radio-tracked until November 1999 covering both summer (May-September) and autumn (October-November) seasons, after which there were no signals received from the bird, and the reasons could not be ascertained. Locations were physically plotted on 1:50,000 scale topographic map and the home ranges were estimated based on the Minimum Convex Polygon (MCP) method using GIS software Arc/info and ArcView Animal Movement Extension. Spatial data developed for GHNP by the Wildlife Institute of India on

Table 1: Frequency and number of bird species caught in different traps

S. No.	Species	Frequency	Total number	Trap
1	Common Hill-Partridge (*Arborophila torqueola,* A. Valenciennes, 1826)	3	4	Net
2	Western Tragopan (*Tragopan melanocephalus,* J.E. Gray, 1829)	1	1	Noose
3	Koklass Pheasant (*Pucrasia macrolopha,* R.P. Lesson, 1829)	1	1	Net
4	Black-naped Green Woodpecker (*Picus canus,* J.F. Gmelin, 1788)	1	1	Noose
5	Spotted Scops-Owl (*Otus spilocephalus,* E. Blyth, 1846)	1	1	Net
6	Eurasian Woodcock (*Scolopax rusticola,* Linnaeus, 1758)	3	4	Net
7	Spotted Nutcracker (*Nucifraga caryocatactes,* Linnaeus, 1758)	1	2	Net
8	Blue Whistling-Thrush (*Myphonus caeruleus,* G.A. Scopoli, 1786)	2	2	Net
9	Plain-backed Thrush (*Zoothera mollissima,* E. Blyth, 1842)	1	1	Noose
10	Scaly Thrush (*Zoothera dauma,* J. Latham, 1790)	2	2	Noose/Net
11	Mistle Thrush (*Turdus viscivorus,* Linnaeus, 1758)	2	2	Net
12	White-collared Blackbird (*Turdus albocinctus,* J.F. Royle, 1840)	1	1	Net
13	Black-and-Yellow Grosbeak (*Mycerobus icterioides,* N.A. Vigors, 1831)	2	3	Net
	Total	21	25	

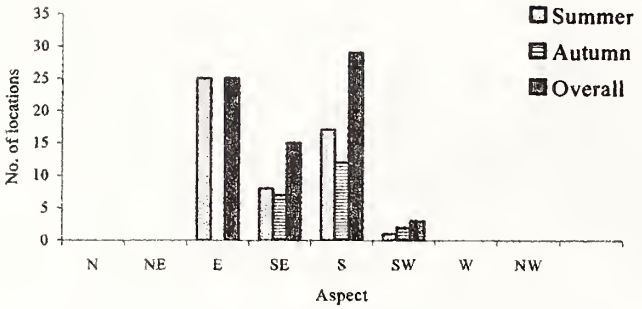

Fig. 4: Radiolocations recorded in different aspect categories

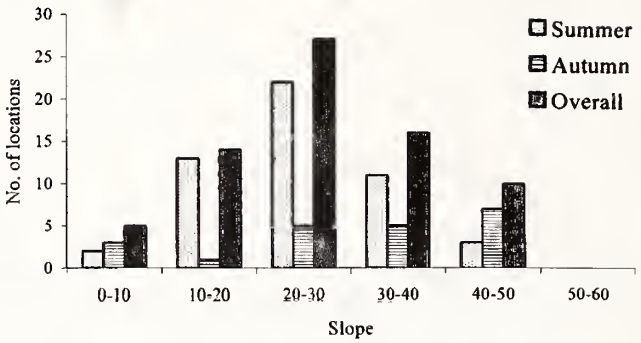

Fig. 5: Radiolocations recorded in different slope classes

vegetation (using IRS-LISS III satellite data), digital elevation model, aspect and slope were used to study the different habitat parameters used by the bird. Random plots (n = 9) of 10 m radius for tree layer, 5 m radius for shrub layers and 1 x 1 m quadrate for ground parameters, were sampled to describe microhabitat features within the home range area. The data collection on the microhabitat features was restricted to only summer season due to time constraints.

RESULTS

Trap success and home range: One female Western Tragopan was caught on May 14, 1999, in a leg-hold noose placed in a *nullah* within a Mixed Conifer and Broadleaf Forest above Grahani *thatch* in the Tirthan valley (Fig. 3). The bird weighed 1.25 kg, and the body length, wing length, wingspan and tail length were 40 cm, 20 cm, 70 cm and 28 cm respectively. During the course of trapping, 12 other bird species including Koklass *Pucrasia macrolopha*, Hill Partridge *Arborophila torqueola* and Eurasian Woodcock *Scolopax rusticola* were also caught, mostly in nets (Table 1). A total of 72 radiolocations representing summer (51 locations) and autumn (21 locations) seasons were obtained. The home range estimated from these locations was 31.6 ha, and it was 20.5 ha for summer and 4.7 ha for autumn months. Since MCP calculated the home range based on outer extreme points, the overall home range estimate also includes the area outside of the summer and autumn home ranges, therefore providing larger estimate than a simple addition of summer and autumn estimates (Fig. 3). The elevation of the home range area ranged between 2,440 m and 2,800 m, however, the bird was mostly restricted to 2,500-2,700 m in summer and between 2,440 and 2,530 m in autumn. The bird moved to a lower elevation between Rolla and Dulunga *thatch* in October and remained there till the signal reception got discontinued in late November. The bird frequented the east, south-east and south facing aspects during summer, while it totally avoided east facing aspect in autumn (Fig. 4), possibly as a response to high cold condition and snow cover in this particular east facing aspect. Use of slope category in summer was unimodal with bell-shape curve as typical of normal distribution, suggesting preference for moderate slopes, but used steeper slopes in autumn (Fig. 5), again perhaps to use areas devoid of snow cover.

Habitat use: The radio-tagged bird used five vegetation types, namely Mixed Conifer Forest, Mixed Conifer and Broadleaf Forest, Broadleaf Forest, Open Forest, and Grassy Blanks (Fig. 4), and did not venture into the remaining two types, alpine scrub and meadows that were represented in the study area. Of the 72 locations, 42 locations (58%) were in Broadleaf Forest followed by 21 locations (29%) in Mixed Conifer and Broadleaf Forest. Mixed Conifer and Broadleaf, and Broadleaf Forests were used relatively in higher proportion in summer, while in autumn, the bird used only the Broadleaf Forest and Grassy Blanks (Table 2). The proportion of different vegetation types within the home range and the corresponding number of radio locations suggests that habitat use by the bird was generally in proportion to availability, but had higher usage in Grassy Blanks, and avoided the Open Forest (Table 2). The Conifer Forests used by the bird were dominated by *Abies pindrow* and *Taxus baccata*. The Broadleaf Forests in higher altitude were dominated by *Acer caesium* and *Quercus semecarpifolia* and the lower altitude forests by *Juglans regia, Ulmus wallichiana*

Table 2: Area (in ha) of different vegetation types within the home range area during summer and autumn (radiolocations are given in parentheses)

Vegetation types	Summer	Autumn	Overall
Mixed Conifer	3.7 (4)	0.0 (0)	3.8 (4)
Mixed Conifer and Broadleaf	7.8 (21)	0.0 (0)	8.7 (21)
Broadleaf	7.6 (25)	2.8 (17)	13.1 (42)
Open Forest	0.0 (0)	0.0 (0)	1.2 (0)
Grassy Blanks	1.5 (1)	2.0 (4)	4.8 (5)
Overall	20.6 (51)	4.7 (0)	31.6 (72)

and *Corylus colurna*. The tagged bird used areas with high tree density (8.4 ±1.2 SE/plot) and shrub density (8.7 ±1.5 SE/plot), and interestingly, the shrub species in all the nine plots was dominated by montane bamboo *Thamnocalamus spathiflorus*. The home range had moderate tree canopy (30% ±1.9 SE) and perennial water sources. The litter cover and litter depth in the plots were 77.8% (± 3.2 SE) and 1.5 cm (± 0.08 SE) respectively.

DISCUSSION

Despite our intensive attempts, trap success for target species was limited to one, but capturing of a significant number of other birds, including the Koklass and Hill Partridge, in these traps suggests that the low trap success for Western Tragopan may not be related to trap efficiency. With such a low sample size, subsequent analysis and interpretation was restricted to descriptive data and any test statistics (e.g. chi-square) was considered unlikely to reflect the biological significance of the species-habitat relationship (Johnson 1999; Krebs 2000). Similarly, due to low sample size, the analysis related to home range estimation was confined to 100% Minimum Convex Polygon (MCP) method, rather than using more robust methods.

Interestingly, the empirical data collected on the habitat use by Western Tragopan in Pakistan (Islam and Crawford 1987) and the recent study in India (Ramesh 2003) have had similar observations on the way different habitat features such as vegetation types, altitude, canopy and shrub cover used by this species. Specifically, the radio-tagged bird proved important to substantiate the general claim of dense undergrowth such as high altitude montane bamboo being the important cover species for Western Tragopan, which in other parts of its range including Pakistan is the *Viburnum* sp. Further, the intensity of use of bamboo patches was largely overlooked by the conventional studies using trails monitoring calling behaviour (Ramesh 2003). This is the only known home range estimate for this species, and is also comparable with the estimates obtained for Cabot's Tragopan *Tragopan caboti* in China during the winter of 1987 (Young *et al.* 1991) and spring 1992 (Changqing and Guang-mei 1993), which were also based on a single female bird. The comparison of the results with other studies might not be directly comparable given the difference in species natural history and conditions, nonetheless, provide an insight on the pattern exhibited by congeneric species.

Though trapping of Western Tragopan was highly challenging, the experiences during the trapping operation suggested that with modifications to suit local conditions and appropriate placement of the traps, it would greatly increase the trapping success. The traps used in the study were found to be safe and effective, which was evident from the trapping of several other ground birds. It was also realized that instead of concentrating our efforts in one area, more trapping parties should have been used to trap the bird from different areas. Another possibility of increasing trap success would be to try trapping just after monsoon, when the population size is generally high after the breeding or try baiting in peak winter when the birds descend to a narrow belt in the lower altitude areas due to resource crunch (both food and habitat) caused by winter snow at higher altitudes (Johnsgard 1986; del Hoyo *et al.* 1994; Ramesh 2003). The selection of spring for trapping appears to have two major disadvantages; 1) the birds had dispersed in wider areas and 2) trapping could cause stress in breeding individuals, thereby reducing breeding success. Since the birds are known to have a very small clutch size (≤ 3 eggs) and have very limited time for breeding (April-June), even the slightest negative impact has high potential to reduce breeding success. In the present case, the female bird had a brood patch indicating the ability to breed, but was not seen sitting on a nest or with chicks after attaching the radio-collar. The only advantage in this season was the breeding/territorial calls produced by males, which enabled us to locate and follow the movement of the male to some extent. Playing back the records of male calls has also the potential to attract the birds to traps in this season.

The Western Tragopan seemed to show site fidelity and intensive monitoring of one particular pair enabled us to trap the female bird. Therefore, it is important for future workers to locate areas frequented by the birds before beginning trapping. Combination of both fall-net and leg-hold noose (placing the noose between fall-nets), would be more effective than independent efforts. The traps in particular were highly effective for trapping ground dwelling birds and studies requiring to trap species such as Koklass, Hill Partridge and Eurasian Woodcock may consider these traps. Another important observation to note is that triangulation was preferred over homing-in method. This was primarily because, the bird skulks under a bush/bamboo patch and the proximity of the observer invariably caused the bird to flush downhill, thus introducing bias to actual movement/home range estimate. Since this particular bird was operating in a small area and on smooth slopes, bouncing of radio signal was not a major issue. However, this need not be a general pattern, since Western Tragopan also occupies rugged terrain where the problems related to bouncing of radio signal is greater. In this study, the error polygon ranged from 5 m to 60 m, and was largely within 25 m radius, but this could vary if more birds using diverse topography and different ranging pattern were tracked. Therefore, in mountain terrain, a hybrid

approach involving both triangulation and homing method is likely to be effective. In this hybrid strategy, after locating the bird by triangulation, the accuracy of the locations could be improved by tracking down the bird up to a minimum permissible distance (flushing distance), from where the bird could be located with certainty based on strength of the radio signal, without flushing the bird. In short, we strongly feel that based on our study, future research with adequate number of radio-tagged birds would provide significant contribution to several interesting facets of its ecology and social behaviour, which would translate into long-term conservation plan for this species.

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